STUDIES ON THE FUNGI CAUSING VEGETABLE ROT IN THE MARKET AND COLD STORAGE

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Specimens of rotted potato, tomato, chillies, sponge gourd, onion and garlic yielded 90 species of fungi. Among these, species of *Aspergillus, Penicillium* and *Fusarium* were of dominant occurrence. Majority of the isolated fungi proved pathogenic, however, *Aspergillus niger, Rhizopus nigricans* and *Fusarium oxysporum* produced hundred per cent infection to their respective hosts. Most of the fungi grew well on basal medium at 25-30 ° C but species of *Aspergillus* showed best growth at 35 ° C.

INTRODUCTION

Fungi play an important role in deterioration of vegetables. Dry rot of potato tubers during storage and marketing has been reported to be caused by various species of *Fusarium* (Qureshi and Ghafoor, 1966). Red pepper fruit has been attacked by *Rhizoctonia bataticola, Curvularia lunata, Alternaria tenuis* and *Geotrichum candidum* (Rao, 1965). Rot of onion in stores has been caused by *A. niger* and *Penicillium* spp. (Maude *et al.,* 1984). Since knowledge of fungal species responsible for vegetable rot is necessary for their control, this paper reports on the extent of fungal infection on various vegetables, their pathogenicity and temperature requirement for growth.

MATERIALS AND METHODS

Isolation: diseased specimens of potato, tomato, chillies, sponge gourd, onion and garlic were collected from the local market, vegetable shops and cold stores in Faisalabad. Small bits from these specimens were disinfected with 0.1% $HgCl_2$ solution, rinsed twice in sterilized water and then placed either on moistened filter paper or on solidified potato dextrose agar, in petridishes which were incubated at room temperature (25-30 ° C). Pure cultures of the fungi were obtained by hyphal tip technique and these were maintained in agar slants in refrigrator at 4 ° C. The isolates were identified under the Binocular Leitz Wetzler Research Microscope with the help of literature (Gilman, 1959; Toussoun and Nelson, 1968).

Pathogenicity tests: Inoculations of isolated fungi were made on their respective vegetables after disinfecting them with methylated spirit and making injuries by a sharp sterilized scalpel. Vegetables injured and inoculated with sterilized water served as the check. All the treatments were placed in sterilized dessicators at room temperature (25-30 ° C) for one week. Then per cent rot for each fungi species on each vegetable was recorded. Re-isolations were made from the inoculated vegetables and the re-isolated fungi were compared with the previously isolated fungi.

Effect of temperature on the growth of fungi: Pure cultures of various pathognic fungi were incubated on basal medium in petriplates and there were four plates for each fungal inoculation. The data on the

colony growth was recorded after incubation at 15, 25, 35 and 40 ° C for one week.

respectively (Table 1). *Penicillium digitatum* and *P. itallium* were recorded 11.11 and

Table 1. Per cent fungal recovery from different vegetables collected from market and cold stores in Faisalabad

Fungus	Number of fungal isolates recovered							Percentage fungal recovery
	Chillies	Garlic	Onion	Potato	Sponge gourd	Tomato	Total	
Alternaria tenuis	-	-	-	-	-	4	4	4.44
Aspergillus flavus	-	2	-	-	-	3	5	5.56
A. fumigatus	-	3	4	-	-	-	7	6.78
A. niger	2	2	3	-	-	1	8	8.89
Curvularia lunata	4	-	-	-	-	-	4	4.44
Fusarium oxysporum	-	-	-	2	-	3	5	5.56
F. roseum	-	-	-	4	-	-	4	4.44
F. solani	-	-	-	6	-	-	-	6.67
Geotrichum candidum	-	-	-	-	-	5	5	5.56
Helminthosporium spp.	-	-	-	2	-	4	6	6.67
Macrophomina phaseolina	-	4	-	-	-	-	4	4.44
Mucor corticolus	2	-	-	3	-	-	5	5.56
M. piriforme	-	-	-	-	2	-	2	2.22
Penicillium digitatum	-	4	2	-	-	4	10	11.11
P. italicum	-	2	3	-	-	-	5	5.56
Rhizopus nigricans	4	-	-	-	-	-	6	11.11

RESULTS AND DISCUSSION

Ninety isolates belonging to 16 fungal species were obtained from the diseased samples of vegetables. Out of these, 30 isolates of different fungi were found on tomato, 17 on each potato and garlic, 12 on each chillies and onion, while only two isolates were recorded from sponge gourd. Among these isolates, per cent recovery of *Aspergillus* spp., *Penicillium* spp. and *Fusarium* spp. was high compared to other fungi. Thus, *Aspergillus flavus, A. fumigatus* and *A. niger* were recorded 5.56, 6.76 and 8.89% from garlic and tomato, garlic and onion and chillies, garlic, onion and tomato, 5.56% from garlic, onion, tomato and garlic, onion, respectively. Isolates of *Fusarium oxysporum, F. roseum* and *F. solani* were recorded 16.67% on potato only. *Geotrichum candidum* and *Macrophomina phaseolina* were recovered 5.56 and 4.44% from tomato and garlic, respectively. *Helminthosporium* spp. were found 6.67% on potato and tomato while *Mucor piriforme* was recorded only 2.22% from spong gourd. Majority of the isolates proved pathogenic to their respective vegetables. *Aspergillus niger* produced hundred per cent infection on injured garlic, onion and tomato while *Rhizopus nigricans* did so on chillies and tomato. *Fusarium oxysporum* proved to

Table 2. Infection percentage in different vegetables inoculated with different fungal isolates

Vegetable	Fungus	Control	Inoculated	
			Injured	Un-injured
Chillies	1. *Aspergillus niger*	-	95	20
	2. *Curvularia lunata*	-	90	25
	3. *Mucor corticolus*	-	85	20
	4. *Rhizopus nigricans*	-	100	20
Garlic	1. *Aspergillus flavus*	-	85	25
	2. *Aspergillus fumigatus*	-	90	40
	3. *Aspergillus niger*	-	100	30
	4. *Macrophomina phaseolina*	-	90	25
	5. *Penicillium digitatum*	-	80	25
	6. *Penicillium italicum*	-	75	20
Onion	1. *Aspergillus fumigatus*	-	80	30
	2. *Aspergillus niger*	-	100	20
	3. *Penicillium digitatum*	-	85	25
	4. *Penicillium italicum*	-	85	20
Potato	1. *Fusarium oxysporum*	-	100	25
	2. *Fusarium roseum*	-	85	20
	3. *Fusarium solani*	-	95	18
	4. *Helminthosporium* sp.	-	84	20
	5. *Mucor corticolus*	-	96	16
Sponge gourd	1. *Mucor piriforme*	-	90	14
Tomato	1. *Alternaria tenuis*	-	100	24
	2. *Aspergillus flavus*	-	95	20
	3. *Aspergillus niger*	-	100	20
	4. *Fusarium oxysporum*	-	100	15
	5. *Geotrichum candidum*	-	95	-
	6. *Helminthosporium* spp.	-	85	25
	7. *Mycrothecium roridum*	-	-	-
	8. *Penicillium digitatum*	-	80	15
	9. *Rhizopus nigricans*	-	100	10

Table 3. Effect of different temperatures on the colony diameter (cm) of various pathogenic fungi 7 days after incubation

Fungus	Temperature (°C)			
	15	25	35	40
Alternaria tenuis	2.4	3.8	3.4	-
Aspergillus flavus	1.0	2.0	5.0	4.5
A. fumigatus	1.2	2.4	5.5	5.2
A. niger	2.0	3.4	6.8	5.5
Curvularia lunata	4.9	6.7	4.0	-
Fusarium solani	3.6	5.6	2.8	0.4
Geotrichum candidum	7.4	6.2	2.3	1.8
Penicillium digitatum	0.8	2.2	1.3	-
Penicillium italicum	2.0	2.4	1.0	-
Rhizopus nigricans	9.2	9.2	8.0	-

be pathogenic at the same level on potato and tomato (Table 2). McColloch (1951) isolated *A. tenuis* from tomato. Maude *et al.* (1984) found that *A. niger* and *Penicillium* spp. were the main fungi isolated from post-harvest onion rot. Chandra and Tandon (1965) isolated *M. phaseolina* from garlic in Texas. Qureshi and Ghafoor (1966) found *F. solani* associated with dry rot of potato. Khan *et al.* (1988) isolated *Mucor piriforme* from fruit rot of sponge gourd in Pakistan.

Best growth of most of the fungi occurred at 25-30 °C (Table 3). *Aspergillus flavus, A. fumigatus* and *A. niger* grew well at 35 °C, while *R. nigricans* showed a wide range of temperature (15-30 °C) for its mycelial growth. The optimum temperature for the growth of *Curvularia lunata, F. solani, P. digitatum* and *P. itallium* was recorded 25 °C, while *Geotrichum candidum* grew well at 15 °C. Temperature studies on the fungi isolated from rotted fruits collected from market and cold stores were carried out by Younis and Mukhtar (1975). They found 25-30 °C optimum temperature range for the maximum mycelial growth of most of the fungal isolates.

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